

Analysis of Some Mathematical Models of Cell Dynamics in Hematology

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Abstract

The purpose of the thesis is the study of some mathematical models of cell dynamics and convex optimization problems applied to chronic myeloid leukemia, by taking into consideration basic concepts, methods and results from the theory of differential equations, such as existence, uniqueness, boundedness, continuous dependence on data and stability of solutions. The thesis is structured in four chapters: **Chapter 1** is entirely dedicated to a medical background which we need throughout this work. In **Chapter 2** we propose a two-dimensional mathematical model of cell dynamics which shows us the transition process from the normal hematopoiesis to the chronic and accelerated-acute stages in myeloid leukemia. The results from this chapter are included in the papers L. Parajdi [1], L.G. Parajdi and R. Precup [2], L.G. Parajdi, R. Precup, E.A. Bonci and C. Tomuleasa [3] and R. Precup, D. Dima, C. Tomuleasa, M.A. Şerban and L.G. Parajdi [4]. The purpose of **Chapter 3** is to develop a mathematical approach of optimal therapy for individual patients in chronic myeloid leukemia, more precisely we consider a convex optimization problem based on the two-dimensional mathematical model introduced in Chapter 2 and we analyze different scenarios of the treatment. All results from **Chapter 3** are original and are contained in the paper L.G. Parajdi, R. Precup, D. Dima, V. Moisoiu and C. Tomuleasa [5]. **Chapter 4** is all about the study of a mathematical model of stem cell dynamics after allogeneic bone marrow transplantation in chronic myeloid leukemia. These results from **Chapter 4** are included in the paper L.G. Parajdi [6]. At the end of the thesis, **Conclusions** and **Further Research** are presented, along with an **Appendix** that contains the code source of the numerical simulations.

Keywords: Stability, dynamical system, numerical simulations, mathematical modeling, cell dynamics, optimization problem, chronic myeloid leukemia, hematology.

Domain: mathematics

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